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The importance of return to work–

How to achieve optimal reintegration in ACS patients

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Abstract

The vocational reintegration of patients after an acute coronary syndrome (ACS) is a crucial step towards complete convalescence from the social as well as individual point of view. Return-to-work rates are determined by medical parameters such as left ventricular function, residual ischemia and heart rhythm stability, as well as by occupational requirement profile such as blue or white collar work, night shifts, and the ability to commute (which is, in part, determined by the physical fitness). Psychosocial factors including depression, self-perceived health situation, and pre-existing cognitive impairment determine the reintegration rate to a significant extent. Patients at risk of poor vocational outcomes should be identified in the early period of rehabilitation to avoid a reintegration failure and to prevent socio-professional exclusion with adverse psychological and financial consequences. A comprehensive health care pathway of ACS patients is initiated by cardiac rehabilitation, which includes specific algorithms and assessment tools for risk stratification and occupational restitution.

As the first in its kind, this review addresses determinants and legal aspects of reintegration of patients suffering an ACS and offers practical advice on reintegration strategies particularly for vulnerable patients. It presents different approaches and scientific findings in the European countries and serves as a recommendation for action.

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Introduction

Coronary artery disease (CAD) including acute coronary syndrome (ACS) is the most common acquired cardiac disease and the leading cause of morbidity and mortality, contributing over 8.75 million deaths in 2015 worldwide.[1] Depending on the country, the mean age of male and female patients indexing with ACS is approximately 51-59 years, of female patients 70-74 years. [2,3] Thus, in general CAD is a disease of middle and advanced aged patients, nevertheless a relevant number of patients are at working age. Independent of the initial treatment strategy, return to work (RTW) rates within 12 months after ACS is about 67-93%.[4,5] The mean time delay until RTW is two to three months.[6] However, in a nationwide Danish registry, although describing a high initial RTW rate of 91%, after one year 24% of the ACS patients were detached from employment due to cardiac and non-cardiac reasons.[7] Although international comparisons are limited by sociopolitical and cultural differences, the likelihood of returning to work after ACS also appears to be lower for women older than 55 years of age than for men. [8] Cardiac events increase the risk for poorer professional conditions including reduced responsible area, part time employment, lower salary and discharge from the jobs with a exemplary mean productivity loss (for example in Spain) of 9,673 euros/person in the index event year (considering the cost per day not worked at 54.65 euros as the minimum wage).[9]

Predictors of successful return to work

While the medical estimation of the patient's ability to RTW is largely based on objective data such as cardiac function including LVEF and exercise capacity as well as existing comorbidities, the patient's self-assessment mainly includes work-related factors (satisfaction with the previous work situation, negative expectations upon resuming work) and general well-being. Regarding the WHO definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" a multidimensional approach in assessing the patient's performance should be sought.

Cardiac-related factors

Severity of myocardial damage due to ACS depends on the area and the duration of coronary occlusion. Left-ventricular ejection fraction (LVEF) at admission have been described as the most important prognostic clinical parameter and remains largely constant after finished inpatient rehabilitation.[10,11] If a discrepancy between LVEF and exercise capacity spiroergometric exists, cardiopulmonary exercise testing (CPET) can be performed to ascertain the anaerobic threshold, peak oxygen uptake and respiratory efficiency.[12] CPET can be used to correlate $VCO_{2\ peak}$ and performed metabolic equivalents (MET). Recent data indicate that the particular the VE/VCO_2

slope determined by CPET is of high predictive value in determining return-to-work rates, (VE/VCO_2 slope >35 indicates a reduced RTW rate by 15%).[13]

In Germany, a patient's maximum and endurance bicycle exercise capacity is interpreted as absolute value as well as in relation to body weight (see Table 1).[14] This so called "Ludwigshafen model" is widely used. Furthermore, there are exemplary tables which correlate energy requirements in METs (depending on body weight) with the performed load during cycle ergometry.[15] Although this scheme can be applied in a variety of patients, it has limitations such as not taking into account age and gender differences. Including this parameters CPET is a more objective and reliable method, but there are only limited data for the assignment into work-intensity groups using the peak VO_2. While cycle ergometry is usually sufficient for activities with low or moderate physical load stress, ergometry seems to underestimate the requirements for heavy physical exertion. In this cases, an individual correlation of the oxygen uptake with the energy expenditure of the specific workplace conditions is desirable.

A Spanish working group has suggested a short algorithm including revascularization status, LV ejection fraction and stress-test for a simplified estimation of work capacity.[16] However, until now there is limited definitive European recommendations on how to execute a stress test for the evaluation of the ability to re-engage occupation.

Imaging using pharmacological or dynamic stress echocardiography is dispensable to a large extent for the assessment of occupational reintegration. It may be helpful to detect ischemia, but do not reflect the exercise capacity of the patient. As most work tasks do not involve peak exercise, the risk of ischemia particular in the revascularized patients after coronary event during work is low.

Rhythm stability is essential particularly for occupational activities, in which short-term arrhythmia-associated consciousness disorders may lead to potentially dangerous situations (professional drivers, roofers, etc.). Treatment/procedural factors are critical for expected recovery as well for instance in comparison to patients treated by PCI, patients after CABG showed a more pronounced cognitive decline after intervention.[17] Patients suffering a complicated ACS (out of hospital cardiac arrest OHCA, acute aorto-coronary bypass grafting or postinfarctional heart failure) require a complex, multimodal reintegration concept for improving the return to work rate. A French work group analyzed the prevalence and factors associated with return to work in OHCA survivors. [18] The RTW rate was 62.8%, while patients with a higher-level job, and with the OHCA occurring in the workplace, were more likely to be reintegrated. As well, a Danish nationwide cohort-study including 30-day-OHCA-survivors who were employed prior to arrest demonstrated a reintegration rate even after organ replacement therapy during ICU treatment of only 53%.[19] Interestingly, congestive heart failure at admission was unrelated to work resumption, as well as the initial coronary intervention (PCI or CABG).[20] The decisive factor seems to be not the type but the effectiveness of the primary treatment.

Existing comorbidities (diabetes mellitus, renal failure, previous stroke, COPD, peripheral arterial disease, etc.) additionally influence the overall estimation of a patient's physical capacity and the return to work rate. [21]

Psychosocial factors

Chronic stress in the workplace results from high requirements and low decision-making potential, or through the combination of high expectations and low professional gratification. Particularly for psychologically vulnerable patients persistent shift work, night work or overtime hours may aggravate the individual effort-reward imbalance.[22] Objectively, job strain has an important impact on risk of cardiovascular diseases, for example on the incidence of atrial fibrillation. The meta-analysis of the Swedish Longitudinal Occupational Survey of Health and two other studies demonstrated a pooled hazard ration of 1.37 (95% CI 1.13-1.67) for atrial fibrillation in stressful occupational exposures.[23] In women there are mainly familial problems, the double burden of work and family that increases the risk of CAD by a factor of three or four. [24] In a prospective cohort study in the Netherlands, depression (OR 3.48; 95% CI: 1.45-8.37) and anxiety disorders (OR 2.90; 95% CI: 1.00-6.38) were significantly correlated with the absence of return to work.[25] Professional reintegration is often limited by the fear of harming oneself because of the work related physical or emotional stress through occupational physical and mental stress. Thus, in the context of the non-cardiac factors, the self-assessment of the patient's ability to adequately perform the previous activity has a high prognostic value for reintegration. [26]

A recent multinational review paper found six barriers (job strain, anxiety, depression, comorbidity, older age and low education) and four facilitators of RTW (job control, work ability, perceived good health and high socioeconomic status) for patients with cardiovascular diseases. [27] However, the lack of correlation between objective and subjective assessment of the performance is not uncommon, since the latter is superimposed on anxiousness and depression especially in patients with physically demanding jobs. Subjective dyspnea is poorly correlated with exercise capacity and VO_{2peak}.[28] Cardiopulmonary exercise testing offers a helpful instrument to differentiate between cardiac, pulmonary and peripheral limitations, thus, motivational problems (eg, persons who desire retirement) can be discovered.

In addition to the medical, psychological and professional factors, the financial situation plays an important role for the patients. The creation of financial work incentives, e.g. by Disability Insurance has led to a higher RTW rate in some Scandinavian countries.[29] It is essential to ensure access to the official financial resources for the patients in a low-threshold manner, taking into account the situational vulnerability caused by survived ACS. However, prospective data across Europe are rare due to different stakeholders and national laws.

In summary, vocational reintegration of patients after acute myocardial infarction is primarily determined by psychosocial parameters and less by the underlying cardiac disease. For this reason, the early diagnosis of mentally conditioned risk of non-return to work by using standardized psychometric questionnaires can be proposed. While the SF-36 (or SF-12) questionnaire and the European QoL 5-dimensions questionnaire (EQ-5D) can be used to assess the general quality of life, more specific psychosocial or vocation-oriented reintegration assessment instruments are available (table 2).[30,31] Particularly, the Hospital Anxiety and Depression Scale is widely used and lower score values has shown to increase the probability of RTW.[32] All these instruments are not cardiac-specific and due to limited comparison data none of the questionnaires can be recommended as the superior one. Particularly in CABG patients, often characterized by at least temporary cognitive impairments, the psychological tests should be performed not too soon after admission to CR as an individual case management to allow a restitution of cognitive abilities and to increase the RTW rate.

However, in addition to the largely objectifiable factors, RTW's likelihood is also determined by individual financial aspects, cultural preferences and intrafamilial decisions. The totality of the limiting barriers can be objectified by the involved professional groups within the scope of the multidisciplinary rehabilitation and correlated for the assessment of the vocational reintegration possibility (Figure 1).

Work-related factors

Working prior to coronary intervention has a high predictive impact for RTW, nevertheless the characteristics of the performed task is important for RTW probability.[12] Work-related factors influencing occupational reintegration include the intensity of physical effort that has to be performed (lifting, carrying and moving heavy objects) as well as specific workplace situations of physical and chemical nature (toxic fumes, atmospheric high pressure or low pressure, high noise level, fine dust load, heat/cold, electric fields and other) have to be considered. Psychologic tasks including shift work and night work, production line work, piecework, or working under time pressure are important professional parameters in the assessment of reintegration ability. Workers in rotating three shift or permanent night-shift schedule demonstrate a modification of their cardiac neurovegetative regulation due to an elevated sympathetic tone both during night time as well as during daytime sleep.[33] Limited data are available of the impact on patients with manifest cardiovascular disease employed in the shift or assembly-line system, however, the pathophysiological impact on heart function and vascular tonus is obvious.[34] Furthermore, particularly patients with manual and physically demanding work are at risk of poor occupational outcomes.[35] The ability to commute (reach the working place either walking or by the use of a

vehicle or public transport) can be a limiting factor for patients with driving ban. The occupational reintegration of patients with implanted electrical devices (cardiac pacemakers, defibrillators), especially in professions in industry, may be difficult.[36] Given a risk of electromagnetic interference (EMI), the implanted electrical device may be influenced by electrical fields and might be a contraindication for the resumption of work in certain areas. The actual incidence of relevant malfunctions of the implanted defibrillator (ICD) due to electromagnetic fields is low (0.5 %).[37] If there is uncertainty about electrical, magnetic or electromagnetic interferences, an exact workplace analysis must be performed to identify potential risks. This should be done by the technical facilities of the organization, the professional association or the Technical Control Board, based on field measurements, and should be coordinated with the representative of the ICD manufacturer. Beside objectively measurable parameters the relationship to the employer must be considered important. Regardless of the disease leading to sickness absence a Dutch working group extracted a trustful employer-employee interdependence as a dominant factor for RTW. [38]

Practical guidance on reintegration strategies

Reintegration of patients after ACS should be considered as an expanded and multicomponent process including initial cardiac rehabilitation, after-care programs and expanded socio-medical support. To estimate the employee´s suitability for work several aspects have to be considered. A practical model for re-adaptation to work after ACS should integrate human and work related parameters for final occupational judgement (Figure 2). Thus, residual job ability (partial - total/temporary - permanent disability) depends on existing above mentioned cardiac, psycho-cognitive and professional barriers.

Cardiac Rehabilitation and return to work

Comprehensive cardiac rehabilitation is one of the core treatment components of patients after an acute coronary event.[39] Besides clinical stabilization the organization of RTW represents a major topic of CR. Occupational recovery and subsequent professional reintegration can be significantly improved by CR due to the time available for the necessary examinations and the institutional infrastructure (dialogue between cardiologists trained in occupational medicine, psychologists and social workers). In comparison to matched controls CR participants independently of age, gender and former profession had a significantly greater reintegration rate.[40] A recently published meta-analysis of 18 studies focusing the reintegration rate following an individually delivered psychosocial and vocational interventions demonstrated an improved work rate at 3 months when compared with usual care.[41] After 6-12 months the effect was neutralized, emphasizing the

impact on desired early reintegration. However, despite robust prognostic impact, across European countries fewer than the half of eligible cardiovascular patients participates in CR.[42]
Patients at risk of poor occupational outcomes should be identified already in the early period of reintegration, optimally during early post-acute cardiac rehabilitation. Overall, profession-related information are considered to a small extent during CR. A French survey described that an advice concerning return to work was completely missing for 44 % of ACS patients and only 53 % of provided information were work-related.[43] Thus, treatment of the underlying cardiac disease (including physical training, nutrition counselling and optimization of secondary preventive medication) is given a comparatively high priority, whereas reintegration strategies leave room for optimization.
Particularly in physically demanding jobs or jobs with specific occupational tasks and risks (heat, in heights, electro-magnetic fields, etc.) the judgment of the company doctor is usually required. For this interface a cooperative approach between participating health care professionals (occupational physician, general physician, rehabilitation cardiologist, company doctor) is desirable as well as a trusting relationship between rehabilitant and company doctor. Company doctors have internal knowledge of the in-house structural processes that can be applied for an individualized reintegration process. Nevertheless, such interdisciplinary teams are rare. [44]

Correlation of physical performance and work severity

The assessment of the job and work environment on the one hand and the assessment of the workers ability on the other are necessary in order to be able to confirm a working ability of the patient, especially in physically demanding occupations. In 1978, the World Health Organization classified the strain at work depending on the performed % of estimated VO_{2max} (light work < 25% $V0_{2max}$, moderate 25 - 50 % $V0_{2max}$, heavy and very heavy > 50% $V0_{2max}$).[45] According to specific tables the work demand can be classified on the basis of metabolic equivalents (METs) into 4 groups (<3 METs – very light work, 3-5 METs – light work, 5-7 METs – moderate work, >7 METs – heavy work) as well. [46] 1 MET corresponds to 3.5 mL O_2 per Kg body weight per minute. To convert from Watt into MET and vice versa, standard calculation equations are available.[47] An Italian working group suggests that a person is able to realize for 6-8 hours continuous employment with consumption of oxygen equal to 35-40% of maximum CPET aerobic capacity (VO_2 max) with peak values during working which must not exceed 2/3 of the maximal achieved values. Return to work may be permitted if the individual functional capacity is at least twice the energy demands of specific work activity.[48] Table 3 demonstrates a selection of MET levels of different professional activities. For example, for a physically demanding job (i.e. chambermaid/hotel housekeeper 4.0 METs full-time corresponding to 14 ml O_2/kg/min) the patient should achieved 35 ml O_2/kg/min as CPET maximum value, for a physically light work (i.e. 1.8 METs) an oxygen uptake of 16 ml O_2/kg/min is sufficient.

The 2011 Compendium of Physical Activities, particularly chapter 11, which correlates specific activities and measured or estimated METs values can be useful for individual job characteristic. [50] Furthermore, for a detailed job description, the International Standard Classification of Occupations of the International Labour Organization (ILO) can be used.[51] Although the upper work load differs between the groups, the average work load of industrial jobs requires less than three times the resting energy expenditure (<3 METs), thus can mostly be classified as light work.[52] However, frequently the work requirement varies during the day, so in case of uncertainty, the requirement can be objected directly at the workplace. A controlled field study analyzed objective cardiovascular demands of a small cohort of construction workers by registration of heart rate and oxygen consumption during several work tasks by using portable oxygen uptake and heart rate monitors.[53] In comparison to other on-site field measurements (i.e. field measurements in ICD patients), the approach of continuous registration of physical activity energy expenditure by wearable tracker, ideally over a longer period can be helpful for occupational reintegration.

Special occupational problems

The chronic negative occupational conditions include long term-sickness absence, long-term unemployment or permanent functional injuries. Under these basic conditions reintegration attempts are often frustrating. However, it can be concluded that patients have historically had to cope with these conditions on their own. If a problematic judgment of fitness to work is to be feared, various expanded reintegration strategies including prolonged rehabilitation, stepwise integration or retraining are being considered (see Table 3).

Expanded cardiac rehabilitation/after-care programs

Expanded CR including aftercare prevention programs enable the sustainability of medical rehabilitation services and serve as a bridge between temporally limited cardiac rehabilitation and the everyday lives of rehabilitants. [54] Across EU nations very few prolonged rehabilitation options are offered by health insurances or other official funding institutions. In a Swedish registry, person-centred care interventions for six months have been successfully implemented for prolonged care after ACS, leading to an improved return to work rate. [55] In Germany, several follow-up programs (IRENA - intensive rehabilitation aftercare, BERONA - occupationally oriented rehabilitation aftercare, IMBORENA - intensified medically and professionally oriented rehabilitation care) have been implemented since 2001. The IRENA is an part time offer of the German pension insurance, which is organized by a rehabilitation institution. Patients extra-occupationally perform up to 24 additional appointments including exercise program, health education and nutrition advices in a period of up to one year after the end of the initial medical

rehabilitation. By participating in the IRENA, a positive effect on the reintegration rate was demonstrated (70.2% of the IRENA group versus 52.6% of the control group within two years). [56] Particularly for professional intensive involved patients, rehabilitation programs using new digital technologies (web-based, non-presence programs) may be helpful in continuing the rehabilitation program despite the lack of time. Cardiac telerehabilitation is a novel CR strategy, that has been proven to be both effective and cost-efficient. [57] As this eHealth based form of CR is delivered remotely, it allows patients to restart working while at the same time engage in ongoing tele-CR. As cardiac telerehabilitation has been proven to induce health benefits also in the long-term, this care strategy is a valuable additional mode of CR delivery. Thus, existing analog modalities could be used and increase the acceptance of the aftercare programs. Further supplementary services offered include rehabilitation sports in a cardiac rehab group and functional training up to two years, financed by health insurance companies.

Part-time (stepwise) reintegration

The part-time or stepwise reintegration is aimed at bringing "work-incapacitated" insured persons who are only partially able to perform their previous activities to "full-time work". This model is used in various somatic and neuropsychiatric disorders.[58] The concept is based on a continuously increase the daily number of hours of work until the full-time work, whereby the type of activities can also be modified. It is arranged in agreement between the employee, the employer, the treating physician, the physician of the rehabilitation facility, the company physician and the service provider. The dominant role is taken by the cardiologist in the rehabilitation clinic. This creates a reintegration plan with the patient based on the discharge parameters. Further modifications can be made in the course of the family doctor or the continuing medical specialist.

The stepwise reintegration is predominately an offer of health care providers in some EU countries where it has been found to be successfully implemented when performed frequently, but in general it is unusual at a wider European level.

Recommendations on return to work across European countries

Due to the heterogeneity or a lack of national guidelines, existing legislations, funding, health systems and cultures across the 28 members of the European Union (EU) the RTW recommendations differ substantially between the countries. Until now, there are no uniform laws or guidelines for occupational reintegration for ACS patients at the European level. The ESC guidelines for the management of acute coronary syndromes exclusively focus on the clinical aspect of acute care.[59] The European Association of Preventive Cardiology has not given any

comments in this respect as well. In 2016, the European Agency for Safety and Health at Work published an extensive document regarding the rehabilitation and return to work as an analysis report on EU and Member States policies, strategies and programmes.[60] The European Union of Medical specialists (UEMS, section of specialists in Occupational Medicine) focuses on the risk of work-related illnesses, but not on scientific research of improved reintegration after illness. The efforts to return to work in the European Union was analyzed in 2010, comparing 13 European countries, but no recent data are available.[61] The ICF model (International Classification of Functioning, Disability, and Health) is rarely used to describe the individual impairment and disability as well as the activity and participation domains in the context of environmental factors.[62] Even on national level for the majority of European Countries clear directives are missing. The guidelines produced by the "Italian Society of Occupational Medicine and Industrial Hygiene" (SIMLII, Società Italiana di Medicina del Lavoro e Igiene Industriale), through the "Consortium for Accreditation and Updating in Occupational Medicine" focus firstly on the definition of judgment of fitness for a specific job. [63] The Scandinavian countries (Sweden, Finland, Norway, Iceland and Denmark) are characterized by a high scientific output regarding RTW.[64] This is made possible by a specific system of recording of population (unique identification number for each inhabitant). Demographics and health data are kept in national registers, which can be used scientifically for statistical research purposes.

Recently, a comparison between intervention policies and social security in case of reduced working capacity in the Netherlands, Finland and Germany has been reported.[65] However, no validated models are yet available on which the RTW probability can be controlled or predicted from EU. This emphazises the urgent need for the creation of a central European statement and of practical recommendations for occupational cardiologists and all contributors.

Driving ability after ACS – current status in Europe

For the 300 million drivers across the EU, since January 2013 new European Driving Licence has been introduced by the European Commission.[66] However, until now, except the EHRA task force on ICD and driving there is no uniform driving policy within Europe for patients with cardiovascular diseases. [67] Even so, there are no published reviews and comparisons regarding national concepts, helping to harmonize Driving License regulations in the EU for patients. While the AHA/NASPE has formulated a scientific statement for personal and public safety issues related to arrhythmias, a common European guideline is urgently needed.[68] The recommendations on driving license are mainly based on data from prospective non-randomized observation studies. The driving ability of patients after acute coronary syndrome is aligned to the group of driving classes, the remaining left ventricular function, and the duration of the arrhythmia-free interval.

In general, a distinction is made between private (cars and motorcycles, group 1) and professional drivers (trucks/lorries, bus driver, pilot, taxi driver group 2).[69, 70] The driving ability of patients with coronary heart disease is primarily aligned to their hemodynamic stability, the duration of the arrhythmia-free interval, and the group of driving classes.[71] Recently, a substantial UK Fitness to drive recommendation has been published, covering multiple cardiovascular disorders including ACS. In this guidance, an exercise tolerance testing is required for Group 2 driver (cycling for 10 minutes with 20 W per minute increments, to a total of 200 W or CPX with completed three stages of the standard Bruce protocol or equivalent safely, without of signs of cardiovascular dysfunction).[72] However, until now every European country published their own statement, which continues to be legally binding.

Call for action

There is a clear need to internationalize the knowledge of country-specific framework in occupational medicine. Regardless of the political background of the individual European countries an harmonized common approach should be sought. In particular it is essential to understand whether different systems in Europe are comparable. On the country level this include factors like participation rate in cardiological rehabilitation, objectification of the RTW rate, recording of the respective reintegration strategies (organizational, in-house, financial and medical) and the long-term success rate in professional reintegration. Here, individual subgroups (younger and advanced age, gender, comorbidities, type and treatment of the index event) should be considered differentiated. All national data should be analyzed by an European scientific board to create a practical approach to synergize current initiatives. Subsequently, multinational prospective registries can be performed to investigate the enforceability of these strategies. Structures that have objectively emerged as the most effective have to be adapted to the underlying social, environmental cultural and economic conditions of the individual countries. In summary, there is a need for action from the national cardiological societies to build the evidence base across countries to address further evidence-based decision making on European level.

Conclusion

For patients after ACS return to work requires increased efforts and should be preferably performed without any delay after completion of the post- infarction rehabilitation program. In addition to cardiological factors, the reintegration of the patients is primarily determined by psycho-cognitive and work-related parameters. Throughout European Countries a considerable inconsistency regarding CR process, RTW rate, length on sick leaves and psychosocial support can be determinate. Due to the increasing spacial and political fusion of the EU a transnational ESC

recommendation for RTW after acute cardiac event including homogenized driving ability recommendation is very desirable.

Author contribution

RR, AS, PD, AA and HV contributed to the conception and design of the work. All authors contributed to the acquisition, analysis, or interpretation of data for the work. RR drafted the manuscript. All authors critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work ensuring integrity and accuracy.

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